

Based on the experience of physical rehabilitation of children with cerebral palsy using Bobat-therapy

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Purpose: to determine the effectiveness of using Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy.

Material & Methods: theoretical analysis and generalization of literary and documentary sources; the use of diagnostic scales "Test cards of motor abilities of children", "Munich Functional Diagnostics", "The Gross Motor Function Classification System" and the method of mathematical data processing.

Results: despite the presence of a large number of methods of physical rehabilitation of children with cerebral palsy, the problem of choosing the most effective one arose. As a result of modern scientific research of scientists from different countries, Bobat-therapy is found to be an effective method in the physical rehabilitation of children with cerebral palsy. However, there is a problem with the definition of criteria for differentiating the use of Bobat-therapy products, and also with the creation of an algorithm for their use, have not previously been investigated.

Conclusion: according to the results of our scientific research, the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method, taking into account the developed algorithm of differentiated use of Bobat-therapy, is effective, as evidenced by the data obtained. For example, the children of the OG noted the improvement of motor functions in the "The Gross Motor Function Classification System" system, the motor capabilities behind the "Test Card for Children's Motor Capabilities" and the normalization of the psychophysical state behind the "Munich Functional Diagnostics".

Keywords: Bobat-therapy, cerebral palsy, physical rehabilitation, motor unctions, psychophysical state.

Introduction

According to modern scientific research, a rapid growth of childhood disability has been noted, caused by damage to the central nervous system and, as a result, pathological changes in the cerebral cortex, the development of paresis, paralysis, hyperkinesia, dystonia and ataxia, which are characteristic of diseases such as cerebral palsy (Cerebral palsy). Various forms of cerebral palsy and features of their clinical manifestations justify the need for a differentiated approach to the choice of an effective method of physical rehabilitation [1; 4; 6].

Among the modern methods of physical rehabilitation (Voyta therapy, Neurokinesiotherapy, System of intensive neurophysiological rehabilitation, Dosage proprioceptive correction, etc.), Standard (therapeutic gymnastics, medical massage, physiotherapy, etc.) and innovative (Bobat-therapy, Feldenkrais, kinesiteyp, etc.) modern scientists highlight the method of Bobath therapy [3; 7].

The first method of Bobat therapy was created in the 30 s and 40 s of the twentieth century by the Czech physiotherapist practitioner Bertha and physician Carl Bobat, the main means were the treatment of the position and application of physical exercises aimed at blocking the action of pathological reflexes on the musculoskeletal system used in the physical rehabilitation of patients undergoing stroke and craniocerebral trauma. Later, in the 50 s, the Bobath-therapy method was enriched in the areas of ergotherapy and speech therapy thanks to the efforts of the Bobath Helen Muller and the gymnastics for newborns, which was developed in the 80 s by their

pupil Maria Keln, after which the method began to be used in physical rehabilitation of children with cerebral palsy of different ages [5; 9].

In the 21st century, Bobat therapy is a modern means of physical rehabilitation of children with cerebral palsy, which is widely used in countries such as Germany, Switzerland, USA, Armenia, Slovenia and Ukraine, where in recent years it is used as the leading method in the physical rehabilitation of children with cerebral palsy. However, the differentiation of Bobat therapies according to the levels of motor abilities, motor functions and psychophysical condition of children with cerebral palsy was not previously investigated, nor was the complex of special physical exercises developed by the Bobat-therapy method and the algorithm of differentiated use of Bobat-therapy in the program of physical rehabilitation of children with Cerebral palsy [2; 11].

Relationship of research with scientific programs, plans, themes. The work was performed in accordance with the theme of the "Summary Plan of Research Work in the Field of Physical Culture and Sports for 2011–2015". On the topic 3.7 "Improvement of biomechanical technologies in physical education and rehabilitation taking into account individual peculiarities of human motility" (state registration number 0111U001734), topic 3.13. "Theoretical and methodological foundations of health of forming technologies in the process of physical education of different groups of population" (state registration number 0116U001615).

Purpose of the study: to determine the effectiveness of us-

ing Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy.

Material and Methods of the research

Theoretical analysis and generalization of literary and documentary sources; The use of diagnostic scales: the Children's Motor Performance Test Card (CTRMD), the Munich Functional Diagnostics (MFD), the The Gross Motor Function Classification System (GMFCS), the method of mathematical processing of data.

Results of the research

As a result of the research, for the implementation of the theoretical provisions of the experimental program of physical rehabilitation of children with cerebral palsy using Bobat-therapy, we determined the criteria for differentiating Bobat-therapy and developed an algorithm for using them in the program of physical rehabilitation of children with cerebral palsy.

The generalization of the obtained scientific data prompted the formation of the organizational and methodological conditions for the practical implementation of a physical rehabilitation program using the Bobat-therapy method in the process of physical rehabilitation of children with cerebral palsy:

The program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method provided for the observance of certain conditions: organizational (creating favorable conditions for practical implementation of the program) and social (familiarization with the program of physical rehabilitation of parents and their children with cerebral palsy formation and development of children with motivation, the use of means physical rehabilitation, ensuring constant monitoring of the psychophysical state of children with cerebral palsy).

The program of physical rehabilitation of children with cerebral palsy using Bobat-therapy has its own components: organizational (provides for an assessment of the feasibility of using the program in the process of physical rehabilitation of children with cerebral palsy and the conditions for its implementation); diagnostic (determines the motor functions of children with cerebral palsy by GMFSS system, motor abilities on CTRMD and psychophysical condition behind the MFD); methodical (planning remedial measures and creating training programs using the Bobat-therapy method control and correction (aimed at evaluating intermediate results) effective (aimed at diagnosing indicators of physical development, motor capabilities, motor functions of the psychophysical state).

Three stages of the practical implementation of the program solved certain tasks. At the preparatory stage, disorders of psychomotor development are identified; parents were informed about the results of the study, stimulated adaptation of the child's body to physical stress, developed and defined complexes of special physical exercises. At the correctional stage, the correction of motor disorders and psychophysical condition, improvement of motor functions and motor capabilities was carried out. The study of psychomotor development changes was implemented at the supporting (stabilizing) stage.

The main component of the evaluation of the effectiveness of the proposed experimental program for the physical reha-

bilitation of children with cerebrovascular disease using the Bobat-therapy method was the study of the psychophysical development of the child with the determination of the correspondence of his profile with the polo-age standards on the diagnostic scales of development: motor functions (GMFCS) motor capabilities (CTRMD) of the psychophysical state (MFD).

The effectiveness of the program was studied according to the developed criteria. At the final stage of the formative experiment, a comparative analysis of performance indicators by the method of mathematical data processing was carried out.

The three components of the algorithm for practical implementation of the program of physical rehabilitation of children with cerebral palsy using the Bobath-therapy method, aimed at correction of motor disorders, improvement of motor function and development of motor abilities, became three stages of practical realization: selection of funds according to their scientific substantiation of efficiency; systematization of the organization of practical classes, their structure, practical implementation and experimental testing; the definition of the criteria for the effectiveness of the practical implementation, containing a list of indicators, which were carried out both as a current control, and a general assessment of approbation.

In accordance with the organizational and methodological conditions established by us for implementing the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method, we selected and grouped Bobat-therapy products into complexes of special physical exercises aimed at correcting motor disorders, improving motor function and motor development. possibilities in the process of physical rehabilitation of children with cerebral palsy, taking into account the degrees of motor functions in the GMFS system, levels of psychophysical state according to the MFD and atelnyh capabilities CTRMD. According to the obtained results, an algorithm was developed for using the Bobat-therapy products in the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method.

The Bobat-therapy was in turn divided into: *basic* special exercise (treatment by position, exercise, breathing exercises, self-service training, games, exercises for tactile sensation development, articulation gymnastics, exercises for small motility, relaxation exercises) *additional* –complexes of special physical exercises, depending on the degree of motor functions in the GMFSC system, psychophysical condition by levels of MFD and motor capabilities by levels of CTRMD.

In the algorithm for the use of Bobat-therapy tools in the program of physical rehabilitation of children with cerebral palsy, Bobat-therapy classes were conducted individually, in the presence of parents, in a specialized room. To determine the volume and intensity of physical exertion, the following criteria were used: the degree of motor abilities in the GMFCS system, the level of motor abilities in CTRMD, and the level of psychophysical condition in the MFD, according to which the motor mode was determined and the initial positions, speed, speed of special exercises, the number of repetitions were determined, the total number of special physical exercises in the complex, the type, nature and degree of difficulty, the amplitude of movements, the duration is busy I breaks between exercises and special physical, as well as the density of oc-

cupation and the emotional factor.

The duration of the lesson was 30–50 minutes on average, depending on the degree of motor abilities in the GMFCS system and motor mode. Physical activity of children with cerebral palsy during classes Bobat-therapy was regulated by motor regimens. Under the conditions of the rehabilitation center, during the course of physical rehabilitation, a sparing-training regimen was used in children with 1, 2 GMFCS degrees for the first three months of the rehabilitation course and for children with 3 degrees GMFCC during the entire 6-month rehabilitation course. According to the results of the current and express controls and according to the indicators of instrumental methods of research, in children of 1, 2 degrees of GMFCS, in the last 3 months of the rehabilitation course, a training motor mode was used.

The first three months of physical rehabilitation using the Bobat-therapy method for children 1 and 2 degrees for GMFCS had an adaptation character, the main task of which was to prepare for increasing loads, regulate muscle tone, reduce the effect of pathological reflexes on the musculoskeletal system, and the like. The means of physical rehabilitation that were used during the training sessions of the Bobat therapy in the sparing-training motor mode were static and dynamic special physical exercises aimed at: relaxation, self-service training, fine motor skills, the development of tactile sensations and basic physical qualities, the formation of basic motor skills, general developmental, restorative, therapeutic, prophylactic and exercise general preparatory character, articulation gymnastics and the like. Also in the classroom Bobat-therapy used breathing exercises, elements of the treatment position and games. The method of conducting was individual. The main focus of the training was on the development of paravertebral muscles, muscles of the stabilizers of the upper and lower limbs, ensuring the development of intermuscular coordination and contribute to the stabilization of the body in space, etc. starting positions: lying, sitting, on all fours, on the knees, calculating the number of repetitions of each exercise, averaged 5–10 times, the pace of the movement – slow and middle and amplitude – and incomplete medium. Dynamic exercises alternated with static stresses, relaxation exercises and the like. Motor occupation density reached 75%. Classes consisted of introductory, main and final parts.

When training motor mode was carried out and the form of training, which consisted of introductory, main and final parts, and under the previous mode, but added more complex special physical exercises and games aimed at strengthening the muscular system, the development of basic motor skills and physical qualities. There was also an increase in the number of breathing exercises. The main tasks of physical rehabilitation were ranked as: strengthening the muscles of the back and torso, the formation of motor skills, consolidation of the experience of physical activity, the development of basic physical qualities. Classes were held individually, the duration is not significantly increased and amounted to 40–50 minutes, motor density – 75%. The dosing of the load was also carried out by regulating the duration of the procedure, changes in initial positions: lying, sitting, on all fours, on the knees, standing, calculating the number of repetitions of each exercise, increased on average and amounted to 10–15 times, the pace of movement performance was slow and average and amplitude – incomplete and medium.

For children with cerebral palsy, the level of motor capabilities of which responded to the 3rd degree in the GMFCS system, physical activity was regulated only within the scope of the sparing-training regime. The method of conducting classes was individual. The main focus of the training was on the development of paravertebral muscles. The means that were used during the Bobat-therapy in this motor mode for this category were special physical exercises: physical exercises; exercises on the regulation of muscle tone self-education training; treatment by position. Physical rehabilitation had an adaptation direction, the main task of which was to regulate muscle tone, reduce the effect of pathological reflexes on the locomotor system, prevent the development of contractures and deformations, training for self-care and care for a child with special needs, and the like. Dosing of the load was also carried out by regulating the duration of the procedure, averaging 35 minutes, changes in the initial position (lying on the abdomen to the back or sides) by calculating the number of repetitions of each exercise, averaging 3–15 repetitions, performing exercises was initially carried out in a slow, and in further – at an average pace with the help of a specialist in physical rehabilitation. The motor density of the classes reached 75%. The classes also consisted of three parts: introductory, main and final.

The main signs of the adequacy of the load were: the absence of unpleasant feelings and overwork, the desire to continue training, the pleasure of training and the like. The following control methods were identified under the influence of physical stress on the psychophysical state of children with cerebral palsy during Bobat therapy: rapid control to assess the immediate effect when the child's reaction to physical stress during physical rehabilitation or the effects of special physical exercises on the locomotor apparatus was studied and the mental state of the child; routine control was carried out at least once every 7–10 days; staged control was carried out to assess the effectiveness of a 6-month physical rehabilitation course, for which children were examined at the beginning and at the end of the course. It should be noted that during any session of Bobat-therapy, a specialist in physical rehabilitation followed the psychophysical condition of the child using such control methods as interrogation and visual observation. As a result of the survey, people learned about their state of health and general condition during the lesson and after it, and visual observation of the effect of physical exertion was carried out by direct observation of the child during the lesson. Also separately studied and discipline, interest, emotionality, external manifestations of overwork (sweating, coloring of the skin, coordination of movements, attention, etc.).

To determine the effectiveness of our proposed physical rehabilitation program for children using Bobat-therapy, a 6-month pedagogical experiment was conducted where the main group (MG) and the control group (CG) were formed by random selection.

During the determination experiment, we found that the most common among the examined children were motor disorders: delay in the formation of motor skills (sitting, turning over, standing, walking), the presence of pathological motor stereotypes, delay in the development of chain statokinetic reflexes. The obtained data became the basis for the formation of MG and CG. CG consisted of 34 children, of which 7 (20,6%) children had cerebrovascular disease in the form of double hemiplegia, 4 (11,8%) had hyperkinetic form, 16

(47,1%) were spastic diplegia, and 7 children (20,6%) – spastic form of hemiparesis; MG – 35 children, of which the form of double hemiplegia occurred in 6 (17,1%), hyperkinetic – 4 (11,4%), spastic diplegia – 18 (51,4%), spastic hemiparesis – 7 (20%). Surveyed were distributed by random sampling, the groups had no statistically significant differences in the studied parameters ($p > 0,05$).

CG consisted of children with cerebral palsy who were undergoing physical rehabilitation using standard approaches during the 6-month course of rehabilitation at the Odessa Regional Center for Rehabilitation of Disabled Children charity fund (ORCRDC) "Future". During the course of physical rehabilitation children of CG received 72 procedures of medical gymnastics and medical massage and 48 classes in soft modular and sensory rooms (sensory integration).

The MG children underwent physical rehabilitation according to the program developed by us using the Bobat-therapy method, which was introduced into the physical rehabilitation process of children with cerebral palsy, who underwent rehabilitation during the 6-month course at the "Future" center. The children of OG during the course of physical rehabilitation received 72 classes of Bobat therapy, sensory integration, 48 lessons in a soft modular room and 48 lessons in a sensory room; 24 procedures kinesiotherapy; 120 procedures of physiotherapy (cryotherapy, sinusoidal modulated currents, interference currents, laser radiation).

Analyzing changes in the levels of motor capabilities in the GMFCS system in children of MG (Table 1), it is necessary to dwell on the main positive effects, which showed an increase of more than twice from 22,9% to 48,6% of the number of children able to sit on the floor and lie down from sitting provisions, as well as walking without additional means of transportation. Positive dynamics was also observed at intermediate levels, which indicates the effectiveness of the program of physical rehabilitation using the Bobat-therapy method. At the same time, children with a total limitation of motor function and the inability to move independently at the end of the course of physical rehabilitation were not observed at all.

Table 1
Changes in levels on the GMFCS scale for children with cerebral palsy in the course of physical rehabilitation, %

Level of GMFCS	MG		CG	
	at the beginning	at the end	at the beginning	at the end
I level	8/22,9	17/48,6	0/0	0/0
II level	5/14,3	6/17,4	7/20,6	6/17,6
III level	12/34,3	7/20,0	14/41,2	16/47,1
IV level	7/20,0	5/14,3	9/26,5	11/32,4
V level	3/8,6	0/0	4/11,8	1/2,9

At the same time, in the children's CG group, the distribution of the level of motor function disturbance significantly differed and was characterized by the prevalence of children with 3 levels of GMFCS (41,2%) at the start of the study, and in each of the 9th children 5 levels were recorded, the main difference being the absence of children with level 1 disturbances of motor function. Despite the weekend differences at the beginning of the course of physical rehab, the main task was to assess

the impact of the methods used. With this in mind, it can be argued that the significant effect of the traditional approach to physical rehabilitation was to increase the options of Levels 3 and 4 on the GMFCS scale, with the number of children with whom at the end of the experiment was 79,5%. It should be noted separately that, with the decrease of children with 5 levels of motor function abnormalities in one child, there was no increase in the GMFCS score up to level 1.

To assess the psychophysical status of children with cerebral palsy, an MFD was carried out, which included establishing a correspondence between the child's age (in months) and the development of a separate psychophysical ability. The results obtained in the form of the correspondence of the existing psychomotor development in percent to the proper (corresponding chronological age of the child) at the beginning and at the end application in the course of physical rehabilitation of the Bobat-therapy (Table 2).

Taking into account the indicated indicators of the percentage

Table 2
Usual data on the correspondence of the psychomotor development to the chronological age of the child in the MG and CG at the beginning and at the end of the course of physical rehabilitation, %

Parameters	MG		CG	
	at the beginning	at the end	at the beginning	at the end
Upright walk	78,2	81,7	54,9	60,7
Fine motor skills	76,5	78,6	55,9	62,4
Perception	73,5	74	50,9	56
Active speech	76	76,9	51,7	56,7
Speech understanding	81,2	77	55,1	60,7
Social age	73,4	74,1	48,3	53,5
Independence	70	72,1	44,8	50,7
Psychological age	74,9	74	47,5	53

of psychomotor development of children depending on the children due, taking into account the average age of children, which was $51,4 \pm 11,8$ months at the beginning of the course, a considerable lag of development was noted according to various indicators, on average was characterized by more than 12 months 18,8% (for understanding speech) up to 30% (for independence) from chronologically determined. As can be seen from Table 2, the majority of indicators on the effect of the course of physical rehabilitation using Bobat therapy showed a slight improvement, but according to the parameters of "speech comprehension" and "psychological age", the inconsistency with age norms was slightly increased, which indicated a certain continuation of the delay in the mental development of this group of children. In general, taking into account the results obtained, it should be noted that a positive trend was observed in increasing the degree of a child's motor capabilities, namely, erect posture and fine motor skills. The latter somewhat increased the possibility of independence of the child. So, according to the results of the study, the algorithm for the differentiated use of Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy is effective.

Analyzing the average assessments of motor abilities of children of exhaust MG to the results of the CTRMD at the begin-

ning and at the end of the physical rehabilitation program for all of their indicators, an improvement was noted in the basic starting positions under study: supine – from 3,9±1,2 to 4,8±0,5 points ($p<0,01$), lying on the stomach – from 3,8±1,2 to 4,8±0,5 points ($p<0,01$), due to the ability to independently take and hold the position. The ability to occupy and be kept in a sitting position is confirmed by positive changes in the indicator from 3,7±1,1 to 4,6±0,7 points ($p<0,05$), and in the starting position by four, the indicator increased from 3,8±1,0 to 4,4±0,8 points ($p<0,05$). Weighted improvements were noted in the starting positions: kneeling from 3,4±1,3 to 4,3±0,8 points ($p<0,05$), while walking from 3,3±1,2 to 4,1±0,8 points ($p<0,05$), standing on one leg from 3,0±1,3 to 3,9±1,0 points ($p<0,05$), certifying the influence of Bobat-therapy on the development of focal abilities by improving the proprioceptive sensitivity and function of the vestibular apparatus and proves the effectiveness of their use in the physical rehabilitation of children with cerebral palsy according to the results of the assessment of their motor capabilities.

In children of the CG, there was a slight improvement in motor abilities in the main initial positions studied: supine – from 3,8±0,8 to 4,1±0,7 points ($p<0,05$), lying on the stomach – from 3,7±0,8 to 4,0±0,7 points ($p<0,05$), while sitting – from 3,4±0,8 to 3,6±0,6 points ($p>0,05$), standing on four – from 3,3±0,8 to 3,6±0,9 points ($p>0,05$), while squatting – from 3,0±0,8 to 3,4±0,8 points ($p>0,05$), kneeling from 2,9±0,8 to 3,1±0,8 points ($p>0,05$), while walking – from 2,5±1,0 to

2,9±0,8 points ($p<0,05$), standing on one leg – from 2,2±1,0 to 2,4±0,8 points ($p>0,05$).

Conclusions / Discussion

The positive effect of the physical rehabilitation program using the Bobath therapy method is evidenced by changes in motor abilities of children with cerebrospinal fluid, such as sitting and self-walking with the GMFCS diagnostic scale, which exceeded the MG contingent in the CG. The effectiveness of the use of Bobat-therapy is shown by the indicators of motor capacity of children with cerebrovascular disease on the diagnostic scale of CTRMD, that in children MG significantly exceeded the indicators of children of CG in the main investigated baseline positions.

As a result of the research, the algorithm of differentiated use of Bobat-therapy in the program of physical rehabilitation of children with cerebrovascular disease using the Bobat-therapy method is effective, confirming the obtained data on the increase of indicators of psychophysical status of children MG according to the MFD.

Prospects for further research are related to the determination of the effect of the PR program of children with cerebrovascular disease with the use of Bobat-therapy on the development of physical characteristics of children with cerebral palsy.

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